U. S. DEPARTMENT OF AGRICULTURE.

FARMERS' BULLETIN No. 151.

DAIRYING IN THE SOUTH.

BY

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WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1902.

LETTER OF TRANSMITTAL.

U. S. DEPARTMENT OF AGRICULTURE,
BUREAU OF ANIMAL INDUSTRY,
Washington, D. C., April 15, 1902.

SIR: I have the honor to submit herewith a manuscript entitled Dairying in the South, and to recommend its publication as a Farmers' Bulletin.

There are many localities in the Southern States where the milk supply is inadequate and the service crude and unsatisfactory. Local supplies of good butter might also be greatly increased to the mutual advantage of producers and consumers. More dairy cows, if kept properly, will unquestionably prove profitable to their owners and beneficial to the owners' lands.

The bulletin was prepared by Prof. S. M. Tracy, formerly director of the Mississippi Agricultural Experiment Station, as the result of twenty years' residence, experience, and observation in Mississippi, with particular reference to Southern conditions and needs. The aim has been to give simple directions for the encouragement and information of those to whom the care of cows and their products is comparatively new, as is the case in the region for which the bulletin has been especially prepared.

Very respectfully yours,

D. E. SALMON,
Chief of Bureau.

Hon. JAMES WILSON, *Secretary.*

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DAIRYING IN THE SOUTH.

Dairying, like hog raising, mule raising, and other lines of live-stock industry, has been greatly neglected in the South, largely on account of the long hot seasons and the absence of the cold springs which were once thought to be an almost necessary adjunct to every Northern dairy. Now, however, that the separator has made it unnecessary to keep the milk for the cream to rise, and the multiplication of ice plants has brought the price of ice within reach, conditions are greatly changed, and dairying is proving a profitable business wherever it is managed with ordinary care and judgment. It is still an unimportant industry in nearly all parts of the South, not from any natural disadvantages of the region, but because the formation, management, and feeding of the herd and the handling of its products are matters which have received little attention, and with which few farmers have any practical familiarity.

It is for the purpose of presenting some facts in regard to such work, of calling attention to its possibilities, and suggesting some practical details necessary to the best success of every dairy that this bulletin has been prepared.

NATURAL ADVANTAGES OF THE SOUTH.

Forage conditions.—The first and most important natural advantage of the South for profitable dairying is its climate, which makes it possible to have good grazing on fresh pastures from nine to twelve months of every year. The least expensive feed for the maintenance of any animal is that which is gathered by grazing. It is impossible to secure a full flow of milk from a cow which does not have fresh and succulent food from fresh pastures, soiling crops, root crops, or the silo, and the best of these is fresh pastures. Natural pastures of Bermuda grass, lespedeza, and other plants are abundant and good through the summer. Cowpeas and sorghum will carry the cows through the fall drought in a constantly improving condition, and by December winter oats, vetches, and crimson clover afford rich grazing, which lasts until the natural grasses begin their spring growth. In no other part of the country is it possible to secure good grazing through so great a part of the year at so little cost.

Climatic advantages.—The mild winters make it unnecessary to provide expensive buildings for protection from cold. Of course, protection from rain should be given, but the double walls, stone basements, and warmed drinking water so desirable in a colder climate, are not needed where the temperature rarely falls to zero, and where there are from eight to ten months without even a frost. The increase in the amount of food needed simply to sustain animal heat in a region where the winter temperature ranges from 20° to 30° F. lower, as it does in most of the prominent dairy sections of the country, is no small item in the cost of maintenance, and in those sections there is always a marked decrease in the flow of milk whenever additional feed is needed for warmth. The more mild the winter the less will be the total amounts both of forage and grain needed for the support of the animal. Tuberculosis, which has become so prevalent and destructive in the colder dairy sections, is seldom encountered south of the Texas fever quarantine line. Texas fever affects animals from north of the quarantine line, but proper precautions will reduce the loss from that disease to not more than 5 per cent.

A home market.—In nearly every part of the South there is a good home market for all dairy products, and the demand will be far beyond the supply for many years to come. In nearly all parts of the Gulf States the retail price of milk is from 30 to 40 cents per gallon, or about one-half the price of canned condensed milk shipped from the North, and that price obtains through the entire year. Good butter seldom retails at less than 30 cents per pound. There are few counties in this section which do not consume double the amount of butter they produce, and in which really good butter will not bring a satisfactory price in the local market. A local market is always the best market for any farm product, and after that market in the South becomes fully supplied with milk and butter of home production, the near-by West Indian and Mexican demands will call for any surplus that may be produced.

Improvement of the soil.—In all regions the marked improvement of the soil and the increased yields of cultivated crops which always follow the keeping of dairy stock are often so great as to give an indirect profit nearly or quite as much as that derived directly from the cows. In the South, where the summers are long and decay is rapid, the humus, or the organic matter so necessary in every cultivated soil, disappears quickly; and a soil, although it may be rich in all the chemical elements of plant food, if kept in constant cultivation, soon assumes an unfavorable mechanical condition, and becomes less easily cultivated, less productive, and more liable to injury from washing than are fields which are grazed, or those where the depletion caused by the growing of ordinary crops is made good by the application of manures. Chemical fertilizers are of inestimable value when rightly

used, but, in order to be most effective, they must be used on soils which are already well supplied with humus. In nearly all the Southern States the productiveness of the soil can be increased more by an increase of humus than by the use of chemical fertilizers alone.

The only practical methods of increasing the humus are the plowing under of green crops and the application of manures. The former is effective but expensive, while the latter is still more effective and far less expensive. In a region where humus is so greatly needed, and where it disappears so rapidly, every cow on the farm will yearly add more to the productiveness of the fields than could be gained by the use of a ton of chemicals, the value of which should therefore be added to the cash returns from her milk and butter. Cows are cheaper than chemicals, and no soil can be kept permanently productive in any other way at so little cost as by the feeding of animals.

In a region where choice feed is so easily grown, where buildings are so inexpensive, where the local markets are so good, where the keeping of stock is so necessary to the continued fertility of the soil, and where there are no special obstacles to the work, dairying can be made profitable as a business, while the sales of milk or butter from even a few cows may give a welcome addition to the income from any farm.

LOCATION.

In practice nearly every large dairy grows from a small beginning in connection with some other line of farm work; hence, the location is not specially selected for the purpose. But when a dairy is to be started from the foundation—land to be purchased and buildings erected—the location should be carefully considered. The most important features of the location are an abundant supply of water, good drainage, a soil which will produce good crops of grain and forage, and convenience to market.

An abundance of good water is an absolute necessity for the welfare of the cows as well as for the convenience of the owner. Good springs or constantly flowing streams are the best; if these can not be found, the location should be one where wells will not be too expensive. Good drainage is essential to the health of both the dairyman and his herd. Without it the stable lot is sure to become an almost bottomless mud hole in wet weather, the buildings and fences will decay much more rapidly than when on dry ground, and the labor of caring for the herd will be greatly increased. Poorly drained pastures produce very poor grazing, and satisfactory winter grazing is impossible on fields so wet and soft that more forage is destroyed by trampling than is eaten by the cows. A productive soil is equally necessary, for barren fields will produce neither profitable crops of grain feed nor good grazing. While a poor soil can be made good, it is always more economical to

pay a good price for land which is already fertile and in good condition than to take a barren and exhausted farm on any terms. Convenience to market adds largely to the profits of a dairy by decreasing the expenses. If milk is to be sold it makes a great difference whether it can be taken to town over a mile or two of good road and then sold direct to the consumer or has to be hauled a much longer distance over rough roads and then shipped by rail to a distant city. Marketing butter calls for less hauling; still it makes a great difference both in the expense and in the condition of the butter when it reaches the customer whether the trip to town requires a full half day or only an hour. Any town having a population of 2,500 or more should afford a good home market for all the products of local dairies aggregating 100 cows or more. A home market where the producer can sell direct to the consumer always yields more satisfactory returns than do shipments to a city dealer or a commission man.

BUILDINGS.

The buildings for a dairy need not be elaborate or expensive, but should be such as will give thorough protection to the cows and their feed, and they should be so arranged that the dairy work can be done conveniently and with the smallest amount of time and labor. They should be well lighted and well ventilated. The mild winters of the South make it unnecessary to pay much attention to warmth, but ample shelter from rain and sun are of great importance.

THE BARN.

There are serious objections to having hay stored over the cow stable. The floor above the stable is often made too low. Unless it is unusually tight, a great amount of dust and litter will sift through onto the cows and into the milk pails; and the feed itself is sure to become more or less tainted by the odors of the stable. When the cows occupy a room with no floor overhead the annoyance from dirt is avoided, and the ventilation is much better than it is possible to secure in a basement story.

Whether the cow stable is a separate building or is in the basement story of the barn, the general plan and arrangement of the stalls will be the same. The stable should be at least 32 feet wide, and may be of any length desired. It makes little difference whether the rows of stalls face the center or the outside of the building. In figure 1 is shown the ground plan of a cow stable, which may be made as long as is necessary to accommodate the herd. In this plan the stalls face the outside of the building, leaving an 8-foot driveway through the middle to allow room for the use of a wagon in cleaning. If the manure is to be taken out in a handcart or wheelbarrow, this passage may be

considerably narrower, thus decreasing the width of the building. On the outside of the stalls, next to the walls, is a passage or feeding alley from 3½ to 5 feet wide for use in carrying in feed and filling the mangers. The manure gutter in the rear of the stalls is 16 inches wide and the stalls are 7 feet deep, of which 2 feet is taken up by the manger, leaving 5 feet clear as standing room for the cows. This may be reduced to 4 feet 6 inches, or even less, for animals of the smaller breeds or below average size. At one end of the stable are four box stalls, each 12 by 12 feet or less, one of which may be used for the bull and the others for calves, cows which are about to calve, sick cows, or for any other purpose which may suit the convenience of the owner. The width of the stalls should be from 3 to 4 feet, varying with the size of the cows and the kind of stall which is used. Very large cows, like Holsteins and Shorthorns, require nearly or quite 4 feet each, while for smaller animals, like Jerseys and Guernseys, 3½ or 3¼ feet will be ample room. One of the leading dairymen of Georgia, who has a herd composed mostly of grade Jerseys, uses the Bidwell stall and finds that 3 feet is ample width for each cow.

This plan may be varied

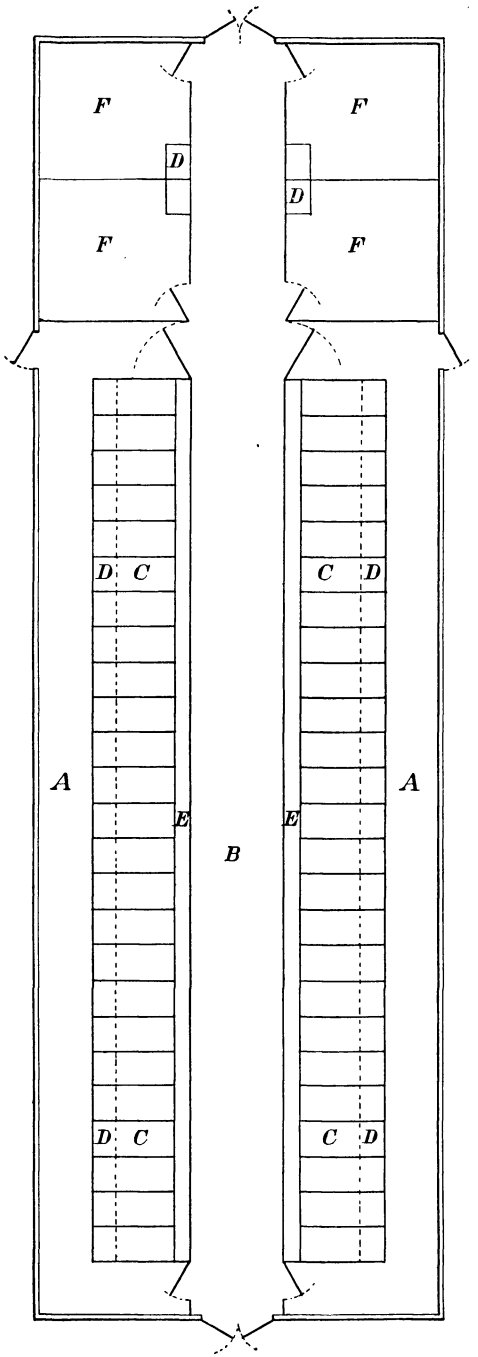

FIG. 1.—Ground floor plan of cow stable: *A*, feeding alleys; *B*, central passageway used in cleaning stable, etc.; *C*, stalls; *D*, mangers; *E*, manure gutters; *F*, box stalls.

by making the stalls face the central passageway, an arrangement which is preferred by many when the stable occupies the lower story of a barn, while the upper floor is used for forage.

These plans may be modified in many ways to suit the location, the positions of other buildings, and the convenience of the owner. Twenty-five or more stalls may be placed in each row, but, when more than double that number is desired, it is usually better to make the building L or T shaped, with the different wings meeting at the grain room.

Another plan that is frequently adopted for a feed and dairy barn combined is to construct for use as a cow stable wide lean-to sheds along one side and one or both ends of the hay barn, with the feeding alley next to the barn wall. The hay barn may be built either with the space for feed storage reaching from the ground to the roof, or with a second floor and haymow above, the lower floor being used not only for feed storage, but for machinery and for cutting and mixing feed. Hay from the upper floor can be thrown down into the feeding alley through suitable openings in the wall; from the lower part the feed is carried through one or more conveniently located doorways. For convenience of drainage, the side shedded in for use as a cow stable should be the lower side. A milk room can be conveniently located on the opposite, or upper, side. In figure 2 is shown a barn of this description, in which one side and both ends have been shedded in. The barn proper is 30 feet wide and 75 feet long. The sheds are 16 feet wide, the feeding alley being 4 feet, and the passage next the outer wall the same, leaving 8 feet for the stalls and manure gutter. Of this the gutter should occupy about 1½ feet and the manger 1½ to 2 feet, leaving from 4½ to 5 feet of standing room for the cows. If stanchions are used, no partitions are needed. The stalls are made about 3 feet 8 inches wide. Three stall spaces are used for passageways and fitted with gates. Three box stalls and 38 stalls are shown.

One advantage of this plan is that it can often be used in adapting to dairy purposes a hay barn or other building, thus considerably reducing the initial expense of starting in the business. Where the drainage is good, all flooring may be dispensed with, except a narrow strip on each side of the manure gutter, thus further lessening the expense.

The floor.—The best floor, and the one which is, in the long run, the most economical, is made of concrete. Such a floor is permanent, and is easily kept clean, either by sweeping or by washing down with a hose. It costs more than a wooden floor, but lasts many times as long.

If it is not practicable to use concrete for the entire stable, it will still pay to use it for the manure gutter and for a space at least a foot wide on each side of it. Brick set on edge serve this purpose well and are quite durable when set in good cement. When the gutter is made in that manner the remainder of the floor may be made of plank, though heavy clay mixed with gravel and well tamped down will do nearly as

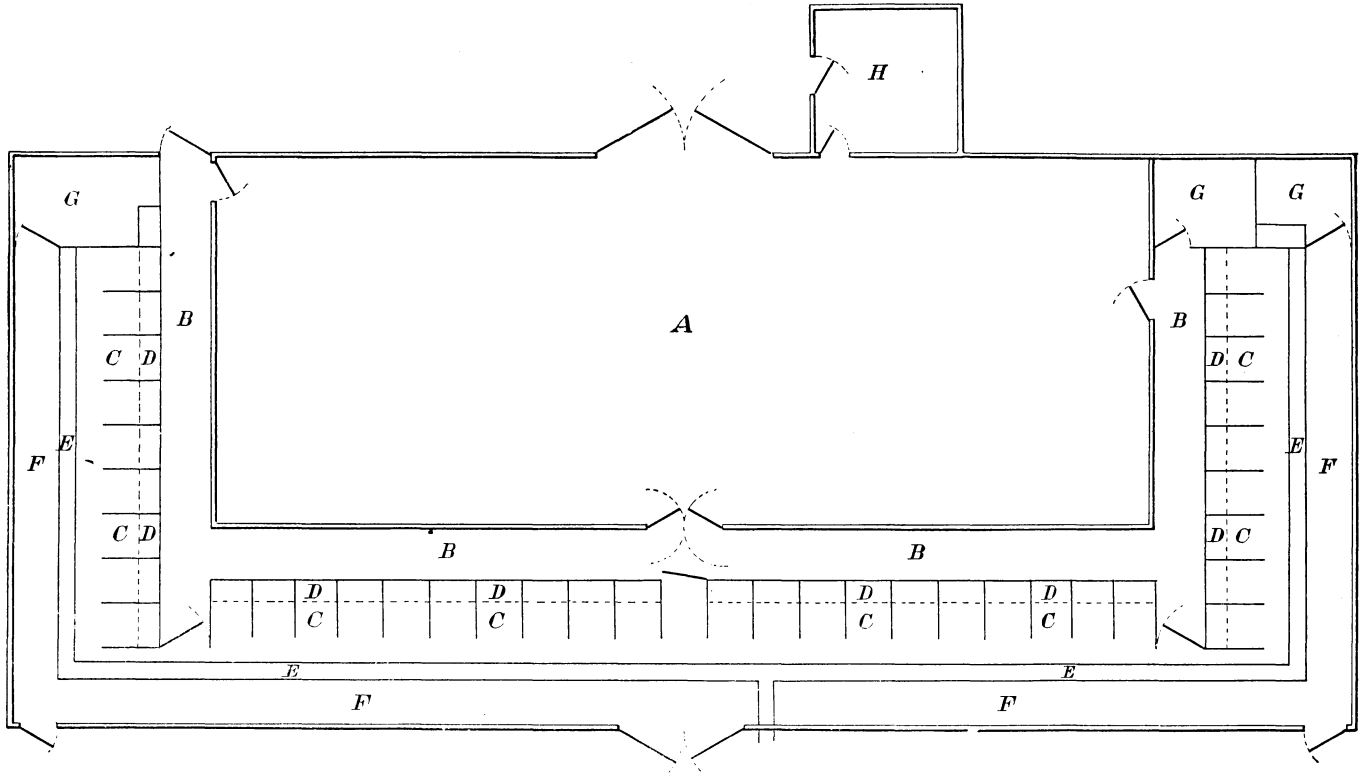

FIG. 2.—Ground floor plan of dairy barn: *A*, main barn for storing and preparing feed, etc.; *B*, feeding alleys; *C*, stalls; *D*, mangers; *E*, manure gutter; *F*, passageway next to outside wall for use in cleaning stable, etc.; *G*, box stalls; *H*, milk room.

well. Whatever material may be used in the flooring, the stalls should have a slope of not more than 2 inches from front to rear, as a steeper slope causes the cow to rest too much of her weight on her hind legs, and long confinement in such a position often causes abortion. A slope of 1 inch in 20 feet is sufficient for the manure gutter.

The bottom of the manger should be from 3 to 6 inches above the floor of the stall, and the manger should be large enough to hold the feed easily so that it will not be thrown out onto the floor and wasted. A very good form is one in the shape of a V with the point cut off, making it about 1 foot wide at the bottom, 2 feet at the top, and from 1½ to 2 feet in depth. It may be made movable so that it can be turned over and cleaned.

The stalls.—The partitions between the stalls need not extend back more than about 3 feet from the manger, and need not be more than 4 feet high. Where stanchions are used, no partitions are needed. Of course, the stalls should be as narrow as is compatible with the comfort of the cows, and where the animals differ much in size it is better to have stalls of different widths, so that no room is wasted. What is known as the "Bidwell" stall is one of the best forms, as it keeps the cows in place without fastening them, giving each animal what is practically a box stall, and at the same time occupying less space than ordinary stalls. These stalls cost a little more to make than do those of the more common styles, but as more of them can be put onto an equal floor space the stable need not be so large to hold an equal number, and so there is little or no increase in the total cost of the building when they are used.

THE MILK HOUSE.

Location.—The building in which the milk is handled should be entirely separate from the one in which the cows are kept, and should be so constructed that it can be kept absolutely clean. A stable always has more or less foul odors from the cows and their droppings, together with dust from the animals and their feed, and milk absorbs these impurities so quickly that it is impossible to keep it pure or in a condition for making strictly first-class butter, without protecting it from all unnecessary infection. Fresh milk is so readily affected by many forms of bacteria, and becomes tainted so quickly from exposure to stable odors, that it can not be handled too carefully. When it is impracticable to have a separate building for the purpose, the milk room should be separated from the stable by two doors having a room or at least a passage way between them.

Requirements.—The size and plan of the building must depend on the number of cows which are kept and the use which is to be made of the milk. If milk is to be the product sold, the building will not need to be more than half as large as where butter is made, and a cellar

will be less essential, though it is a great convenience in all lines of dairying. One of the most important points in the construction of the building is that it should contain some provision for cooling the milk rapidly, and for keeping it at a low temperature. An abundant supply of water is always necessary, and where it is possible to locate the building over a cold spring, that is the best place for it. A milk room should never be built over a running stream, excepting very near its source, as the water is liable to be contaminated by surface drainage, and, in the South, it soon becomes so warm as to be of little value for cooling the milk.

The ground floor of the building should be large enough to give ample room for handling the fresh milk, for churning, and for the separator, if one is used. A separate room must be provided for the boiler and engine when they are used. The floor and sides should have a perfectly smooth finish, so that they can be washed easily, and the sides and ceiling should be white, so that any dirt will be easily seen, and the room should be made as light as possible. It is never good policy to paint the room any dark color, as thus dirt will not show. Good butter can not be made in a filthy room, and the walls, floor, and ceiling should be so light-colored that any dirt may be seen and removed at once. Sunshine and fresh air are among the best of purifiers, and should be admitted so freely that the room will be thoroughly dried at least once every day.

The two-storied cellar.—Where a good spring is not available it is usually better to have a large cellar under the dairy building, as it is much easier to maintain the low temperature needed in a cellar than in a room above ground. In figure 3 is shown a two-storied cellar which may be constructed under the milk house or other building, as convenience may dictate. The upper story is about 6½ feet in depth, the floor being 4 to 4½ feet below the surface of the ground, the floor of the room above being 2 to 2½ feet above the ground. Light can be admitted through windows placed in the wall just above the ground, but these should not be used for ventilation. Additional light can also come through the trapdoor in the floor of the milk room, or, if desired, through a glazed space in the floor. The lower story of the cellar is 8 feet in depth. Light can be admitted only through the trapdoor, or through glazing in the floor, and a lamp may have to be used in doing some kinds of work. The walls should be of brick and may be coated with cement. Shelving may be put in along the walls. The object in view is to secure the coolest possible place for the keeping of milk and butter. This end can be secured far better with the two-storied cellar than with one which opens directly into the building above. The upper story of the cellar may be used for a work-room, for storing utensils, or for any other purpose desired.

A cellar of this kind may be ventilated in several ways. Some

method should be adopted by which the incoming air will be as cool as possible. Perhaps the best way to secure this is by means of the

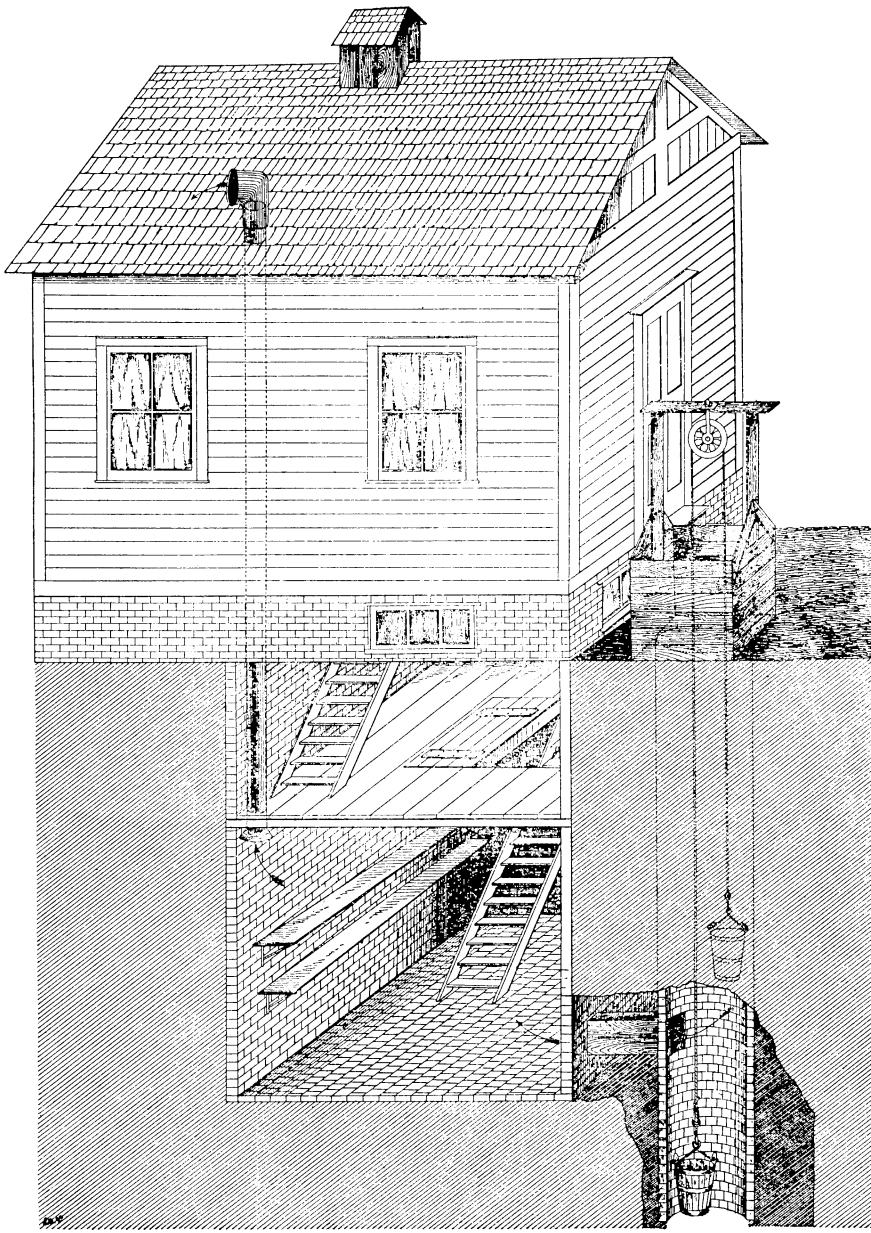

FIG. 3.—Sectional view of milk house with cellar.

subearth air duct, described later on. The plan shown in figure 3 is also excellent. A current of air passes down through an adjoining well,

from which an air passage is opened into the lower cellar. The air passes out through a tube or pipe leading from the lower cellar to the roof of the building above. A better draft will be secured by running the ventilation tube up at a point which will bring it out near the comb instead of near the eaves, as shown in the illustration. The top of the tube should be fitted with a self-regulating revolving ventilator hood to secure the greatest efficiency. If, during the cooler parts of the year, it is more convenient to use the milk room above instead of the cellar, that part of the pipe leading from the floor to the roof of the building may be removed, and then the current of cool air passing through the well and the cellar will flow out into the milk room, thus aiding in the regulation of its temperature.

The one-storied cellar.—While the same degree of coolness can never be secured with a single or one-storied cellar, the construction of such a cellar is less expensive and its use involves less labor. The bottom of the cellar should be not less than 8 feet below the surface of the ground. Sides and bottom should be made of brick or stone, laid in cement, and may be finished off with a smooth coating of cement, so they can be washed easily and kept clean. Whatever style of cellar is used, the bottom should have a slight inclination toward one corner in which a large earthern jar is sunk so that its top is flush with the floor to catch and hold the water used in washing. A simple platform lift may be used to raise and lower the milk and cream. Air inlets to secure the necessary ventilation are often provided by making a part of the wall double, with openings to the outer air near the top and other openings into the cellar near the bottom. Of course, the outer openings must be protected with wire screens. While this plan provides for the needed ventilation, it does little to regulate the temperature, the incoming air being too warm in summer and too cold in winter. The room in which milk and cream are kept should have an even temperature not higher than 50° to 55° F., and it is impossible to secure this when the ventilation is direct without the use of considerable ice in summer and fire heat in winter.

The subearth air duct.—What is known as the "subearth air duct," already referred to, is of great assistance in maintaining an even low temperature, and, at the same time, it secures perfect ventilation. This arrangement is very simple, easily constructed, and not unduly expensive. It consists of an underground passage 100 to 150 feet in length, one end opening into the bottom of the cellar and the other to the outer air. This air duct must be not less than 15 inches in diameter, while 18 inches is much better, and it is usually made of glazed sewer pipe. A modification of this plan, which seems to be an improvement on the original design, consists of three or more runs of pipe, each from 6 to 10 inches in diameter, all being laid in the same ditch. Professor King recommends the use of not less than three lines of

10-inch tile in preference to a single line of equal capacity, as they expose a much larger surface to cool the incoming air. The ditch in which the tiles are laid must be below the bottom of the cellar at the inner end, and the upper side of the pipes should not be less than 8 feet below the surface of the ground at any point, while 10 or 12 feet below will be still better. The duct should be straight, so there will be little obstruction to a free inflow of air, and should have at least a slight fall toward one end, so that any water which may seep into it may be easily removed. The perpendicular part of the air inlet should be of brick from the ends of the pipes to the surface of the ground, above which it should be a galvanized-iron pipe at least 18 inches in diameter with a movable hood having a wind vane of sufficient size to keep the mouth turned toward the wind. If convenient, the inlet should be on somewhat higher ground than the building, though it is sometimes placed on lower ground. In all cases, however, the inlet for the fresh air must be at a good distance from the stable or any other source of foul odors.

When this system of ventilating and cooling is used the room above the cellar should have a ventilator shaft at the top, while the sides should be so close that all the air which enters will be drawn in from the cellar through the opening for the lift, which should be immediately below the ventilator. With a building constructed in this manner, the air which has become warmed in the room rises and passes out through the ventilator, and is constantly replaced by fresh air which is drawn in through the air duct at practically the same temperature as the surrounding subsoil, which, in the South, is from 50° to 60° F. Such an arrangement effects a very great saving in ice, rendering its use entirely unnecessary through the greater part of the year, secures the best ventilation, and the best possible place for the creaming of milk when it is set in pans or in deep cans, for the storing of cream from a separator, and for the working and packing of butter.

THE WATER SUPPLY.

Sources of supply.—An abundant supply of pure water must be provided in order to secure the best results. A cow can not produce a large yield of milk without drinking a large amount of water, and she can not produce good milk if she is forced to drink water from filthy pools. A good spring or a small running stream which is not contaminated by drainage is the best source for water, but the supply must be constant. The stream which fails to maintain a continuous flow during the late summer drought and the spring which fails to be full and running over through the driest season are of little value to the dairyman. Where such a supply is not available a good well is a very satisfactory substitute. An abundance of good water is so essential to the health and productiveness of the cows, and it is so necessary

to have an ample supply for use in the milk room, that it should receive as much attention as the buildings or any other part of the outfit.

Troughs.—When the cows are to be kept in the stable through the winter, each stall should have its drinking trough kept filled with water where the cows can reach it at any time. Such an arrangement is not expensive, as iron troughs large enough for the use of two cows in adjoining stalls can be purchased very cheaply. By placing them on a level in connection with a supply pipe and using a single float valve to regulate the flow, there will be no waste and each trough will receive a frequent supply of fresh water. There are objections to this individual system of watering, however, and some good dairymen prefer the overflow trough, so placed that cows can go to it in stormy weather without exposure.

When the cows are to spend the day out of doors the feed lot should be well provided with troughs, so that each animal can drink whenever she wishes without danger of the weaker being worried and driven away by the stronger.

Windmills.—A windmill costing from $50 to $100 will not only furnish sufficient power to do all the pumping, but also for grinding feed. Mills which are less expensive, but capable of doing good work, are often made by using the gearing of old mowers and other worn-out farm machines.[a] Such mills can be constructed by the exercise of a little ingenuity with a cash expense of from $2 to $10 and, while not equal in power to the better kinds of factory-made mills, will do a surprising amount of work. Such a cheap homemade mill can not be made to change its position with each change in the direction of the wind, and so should be built facing in the direction from which the wind comes most frequently. The water tank should be large enough to hold a supply for several days.

Open pools.—Open pools which are filled by surface drainage should never be used when it is possible to secure water from any other source. Of course, water from such pools is often used, and too many pastures have no other supply, but neither good milk nor good butter can be made without good water, and where both cows and hogs have free access to a pool the water soon becomes unfit for use. The margins of open pools are always favorite standing places for the cows, and every rain carries in a fresh supply of droppings and other filth. When the weather is warm, flies abundant, and the pasture without shade, the cows will stand in the water for hours to keep cool, and thus add still more filth, until a small pool becomes almost like a tank of liquid manure. While it is true that many cows have only such water to drink through the entire summer and do not seem to suffer in health,

[a] See Bulletin 59 of the Nebraska Experiment Station for details in the construction of homemade windmills.

it is impossible for any cow to secrete good milk, or milk which will make butter of fine flavor or butter which will keep well, when she is forced to drink such a mixture of mud and offal.

It is not difficult or expensive to arrange a pool so that the water will be kept fairly pure. The pool should be located so that all water flowing into it shall come from land covered by a permanent sod, as the drainage from a cultivated field will contain so much mud that the pool will soon be filled. Before the embankment is constructed a galvanized-iron pipe should be laid from the lowest point in the proposed pool to some convenient point below the embankment where it can open into a trough at a level as low as the bottom of the pool. The end of the pipe which is in the pool should be turned up a foot or more, so that it will not become covered with sediment, and should be protected by a perforated cap which will serve as a strainer. The lower end of the pipe should have a float valve in the trough, and, where there is danger from freezing, should be boxed and packed with sawdust. The pool itself should be inclosed by a good fence which will keep out cattle and hogs.

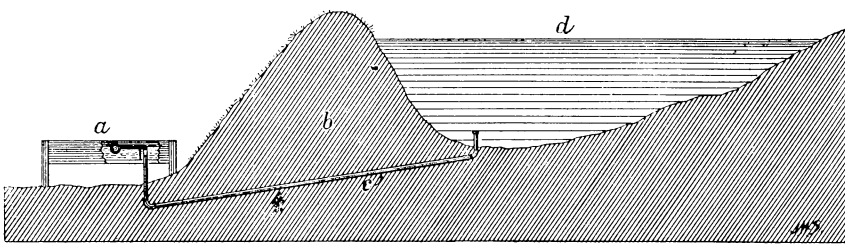

FIG. 4.—Artificial pool with trough and connecting pipe.

When arranged in this way it is possible to have a pool which will furnish very fair drinking water for cows, but as it can not be used for other purposes, and is sure to become filled with a mud deposit in the course of a few years, it can never be regarded as anything but an inferior and temporary substitute for a running stream or a well. Taking everything into consideration, a good spring located above the stable and other buildings, or a well with a windmill and tank from which pure water can be piped into the stable, the drinking troughs, and the milk room, will be found the most satisfactory, and, in the end, the cheapest source for the water supply.

BREEDS OF COWS.

The best cow for any dairy is the one which will give the greatest profit. To which one of the so-called dairy breeds this cow will belong depends on the location, the character of the pastures, the care given to the herd, and whether the product to be marketed is milk, butter, or cheese. The dairyman who depends wholly on the sale of milk may

find it more profitable to keep a different breed from the one he would select were he making butter or cheese, while, if he wishes to produce beef and also a moderate amount of milk or butter, a still different breed may be better adapted to his purpose. Many swine raisers claim that there is "more in the feed than in the breed," but this is not true of cattle. The best breed for milk or butter is never the best for beef.

The more common breeds for dairy purposes[a] are the Jerseys, Ayrshires, Guernseys, Holstein-Friesians, Devons, and milking strains of Shorthorns, though Dutch Belted, Brown Swiss. and a few other breeds have their admirers among dairymen.

The Jerseys.—The Jerseys, formerly known as Alderneys, are in this country the most common breed, where cows are kept for strictly dairy purposes and with no regard for beef qualities. The cows are small, generally weighing below 1,000 pounds, usually rather angular in outline, nervous, good feeders, and producing liberal yields of very rich milk. For generations they have been bred exclusively for the production of butter, the quantity of milk and the size of the cow being regarded as matters of little or no importance. Their milk is usually very rich, that from a large number of cows tested at various experiment stations, as reported by Professor Woll, averaging 5.4 per cent of butter fat, and those at the Columbian Exposition averaging 4.88 per cent. They are such persistent milkers that it is sometimes difficult to dry them off between calves, and the records of many herds show an average yield of over 5,000 pounds of milk per cow per year. Records of individual cows show much larger yields, some running as high as 10,000 to 12,000 pounds, and there are two well-authenticated records of cows which have produced over 16,000 pounds of milk within twelve months. That the milk of Jersey cows is rich in butter fat is shown by the fact that many herds produce an average annual yield of over 300 pounds of butter per cow. Herds averaging 400 pounds per cow are not uncommon, while single animals have produced more than double that amount within the same time. Jerseys are more numerous than cows of any other single breed in the South, and many of the native cattle in that region show a strong mixture of Jersey blood.

The Ayrshires.—Ayrshires resemble Jerseys to a considerable extent, and are very popular in the dairy sections of Canada and the Northeastern States, though not common in the South. The cows are rather small in size, seldom weighing more than 1,000 pounds each, but are good milk producers, 5,000 pounds of milk per year being a common yield. One noted herd, averaging 14 cows in milk, has a record of an average product of 6,407 pounds of milk per year for each cow for

[a] See Farmers' Bulletin No. 106, Breeds of Dairy Cattle.

nineteen years. In another case 19 cows averaged 6,956 pounds in one year, and in numerous instances single cows have given from 10,000 to 12,000 pounds. The milk is somewhat above the average in quality, though not so rich as that from the Jerseys. Woll gives the average fat content as 3.6 per cent, while the New York (Geneva) Experiment Station gives it as 3.57 per cent. The cows are not as gentle as are the Jerseys and Holsteins, but are more active, better "rustlers," will live on poorer feed, and will find grazing on rougher pastures. Steers and dry cows fatten readily, and, though small, make excellent beef.

The Holstein-Friesians.—The Holstein-Friesians, though one of the oldest of the dairy breeds in Europe, are of comparatively recent introduction into this country, and are giving excellent satisfaction wherever they are handled under proper conditions. They need luxuriant pastures, rich feed, and good care to make them succeed well, and are likely to be disappointing when they are not given the best of feed and attention. The cows are large, weighing from 1,000 to 1,400 pounds, and are irregularly marked with black and white. They are very gentle and easy to handle. They fatten quickly at any age, and so are readily turned into beef when past their usefulness in the dairy. The calves are large and strong, and the surplus males always bring good prices as veal, or they may be made into profitable steers. The cows yield enormous quantities of milk, sometimes averaging per month an amount equal to their own weight for ten or twelve successive months.

Although the quantity of milk produced is far beyond that from most other breeds, its quality is usually poor, and in some cases has been below the standard fixed by State or municipal laws. The milk is usually lighter colored than that from the Jerseys, even when fairly rich, and those who have been accustomed to milk of a richer appearance sometimes object to buying it on account of the absence of color, which gives an impression of poorer quality. Many individual cows, however, produce milk of excellent quality, and there are records of cows which have yielded as much as 25 pounds of butter in a week.

The Devons.—Devons are very popular in many localities, especially where the production of milk and butter is not the sole object for which the animals are kept. The cows are of good size, averaging perhaps 1,000 pounds in weight. They are good rangers, quick and active, but very docile, easily handled, and fair but usually not persistent milkers. The milk, however, is unusually rich in quality, the tests reported by Professor Woll averaging 4.6 per cent of butter fat, while tests of 72 animals reported by the New York Experiment Station averaged 4.15 per cent. Some families of the Devons contain heavy milkers, yields of 5,000 pounds per year being not uncommon. Where it is desired to combine beef production with dairying the Devons are very satisfactory, as the calves grow rapidly and the steers

fatten very quickly. It is important to note that Devons have been sucessfully introduced in different parts of the South, and have shown their value in improving the common stock of the country for both milk and meat. The steers make better work oxen than those of any other breed.

The Shorthorns.—While the Shorthorns are usually regarded as a beef breed, there are many good milkers among them, and the "milking strains" are favorites where the production of beef is the main object, and at the same time a good yield of milk and butter is desired. Individual cows of this breed have been known to produce 10,000 to 12,000 pounds of milk in a season, and entire herds have averaged from 6,500 to 7,500 pounds. The milk is of good quality and creams easily, though the butter is usually pale in color. At the Columbian Exposition test the Shorthorn milk averaged 3.64 per cent of butter fat, while the report of Prof. Woll gives the average as 3.97 per cent. These cattle are less common in the Gulf States than are those of the other breeds mentioned, and, where found, they have been raised almost exclusively for the production of beef, but it is not difficult to find there individuals and even large herds which are also profitable dairy animals. This is particularly true of grade cows of this blood—the offspring of Shorthorn bulls from milking families.

The dual-purpose cow.—Though many attempts have been made to develop a breed of cattle profitable for both beef and milk, success in that direction has not yet been reached, and it seems more than probable that such a breed will never be secured. It is the natural tendency of every cow to use her surplus food either in growth and the accumulation of fat or in the production of milk. Either of these tendencies may be greatly strengthened by intelligent breeding and selection, but no breed has ever been developed which excels in both beef and butter-making qualities, and improvement in either direction has usually been accompanied by a corresponding loss in the other. It is true that there are some breeds which make animals of fair size and which are also fair dairy animals, but they are only fair as either. The best beef animals and the best milking animals have never been found in the same individuals or even in the same breed, and the cattle raiser who attempts to raise beef for a living and at the same time to make money by using his cows in a dairy is almost sure to find one branch of his business unprofitable. A profitable beef animal is one thing, while a profitable dairy cow is something quite different. The man who expects to make his living from a dairy should select the breed which will give him the greatest amount of butter and milk from the smallest number of animals at the least cost.

Dairy breeds compared.—Other breeds have admirers who point with pride to the large miik records made by their favorites. Each breed has its special good qualities as well as its peculiar weaknesses, and

no one of them is best suited to all localities or to all branches of dairying. In breed tests made by the Maine, New York (Geneva), and New Jersey Experiment stations, the breeds tested have made averages which place them in the following order:

1. As to yield of milk: Holstein, Shorthorn, Ayrshire, Guernsey, Jersey, Devon.

2. As to richness of milk: Jersey, Guernsey, Devon, Shorthorn, Ayrshire, Holstein.

To summarize the matter of breeds: The Jerseys produce a large yield of rich milk and are good rustlers, but of little value for beef; the Ayrshires are good milk producers, will thrive on a poorer pasture than most others, and are easily fattened when wanted for beef; the Holstein-Friesians produce an immense yield of milk which is not rich, and are easily made into good beef, but require the best of care and an abundance of rich and succulent feed; the Devons produce a moderate amount of rich milk and are quickly made into good beef; the "milking strains" of Shorthorns produce a good yield of milk which is of good quality, and can be turned into excellent beef at any time, but are not good rustlers and need the best of pastures to do well. Probably three-fourths of the pure-blooded cows now in the Gulf States are Jerseys.

BUILDING UP A DAIRY HERD.[a]

Whatever breed may be chosen for the dairy or for any other purpose, the individual animals should be good of their kind. A good purebred animal is the best, but a poor specimen of any breed, no matter how good its pedigree, is worth less than a good scrub.

The cows.—The selection of animals for the foundation of a dairy herd is a matter which requires great care, judgment, and experience.[b] The best of feed and management can not make a profitable cow of one which naturally gives only a small amount of thin milk. When one has unlimited means at his disposal it is comparatively easy to buy cows which have established records as heavy milkers, but that method is too expensive for the dairyman who must depend on the sale of dairy products for his income. Under all ordinary circumstances it is better to begin by buying the best herd which can be afforded, and then to maintain and improve it by raising calves from the best cows and occasionally buying a cow which is known to be unusually good. As the herd increases beyond the desired limit, either by breeding or by purchase, the inferior cows should be sold, so that the quality of the herd as a whole will show a constant improvement. The poorest cows in the herd should always be for

[a] See Farmers' Bulletin No. 55, The Dairy Herd.

[b] See Farmers' Bulletin No. 143, The Conformation of Beef and Dairy Cattle.

sale at little more than their beef value, while the best should always be kept until their period of usefulness is past.

When it is not possible to purchase pure bloods, the first cows purchased should be good grades of the breed selected. None but good animals should be purchased at any price, as a poor cow—one which will not yield at least 200 pounds of butter in a year, or its equivalent in milk—will little more than pay her board. A real lover of cattle (the only man who will succeed as a dairyman) will not be satisfied without owning a few purebred and registered animals.

The bull.—In all cases the bull should be a purebred, and he should be selected from a family of good milkers. Usually it is better to buy a young bull, as one which has been raised on the place and has learned to know his master is much more easily handled than is a mature animal when brought to a strange place. When a good bull has been secured and has proved his merit, he should be kept as long as possible. He should always have kind and gentle treatment, but there should never be any question as to who is master. A ring should be put into his nose by the time he is a year old, and he should always be led by a strap or staff snapped into this ring. Whenever he is tied he should be fastened with a rope he can not break, and all fences should be so high and strong that he will never attempt to go over or through them. When a young bull is handled properly he never learns his strength, and so can be handled with comparative safety, but success in a single unruly attempt will teach him a lesson he will never forget. Many bulls live to old age without showing any unpleasant temper, but one should never be trusted, as the older he becomes the greater is the liability to a sudden vicious outbreak.

It is much better for both the health and temper of the bull to give him abundant exercise, either in a pasture or at work. When he can not have a pasture to himself it is good economy to use his surplus energy in doing useful work on a tread power. Such a power, of sufficient size to give him all needed exercise, costs little, and it is much better to have him do the churning, pumping, cutting hay, and grinding feed than to have him waste his time and strength tearing up the ground or attempting to get out of his lot, or to become lazy and vicious standing in his stable. While it is not often good practice to keep him in the pasture with the cows, he should be kept in their sight as much as possible, and in the same stable at night.

When cows should "come fresh."—Whether cows should be bred to drop their calves in the fall or in the spring depends largely on how the marketing is to be done. Milk and butter usually bring better prices in winter than in summer, and when such products are disposed of at wholesale it is better to have the larger supply when prices are highest, but when one sells at retail to regular customers he must arrange to have his supply nearly constant in order to hold his trade.

A cow will give more milk and give it at a smaller cost when her calf is dropped in the fall than when she is "fresh" in the spring. When a cow "comes fresh" in the fall she is almost immediately put on her winter feed and will continue to give a liberal supply of milk until the spring grazing stimulates a renewed flow during the later months of her lactation period. Her dry period then comes in late summer, when prices are usually low, when stabling is uncomfortable, and when the handling and care of the milk is more troublesome than at any other time. Service in December or January will allow the cows to rest during the hottest and most trying months, when they give the smallest profits, and make them most productive when prices are highest.

"Drying off" cows.—The cow should "go dry" a month or six weeks before she is expected to calve. Some cows are such persistent milkers that it is impossible to dry them off; but such cases are rare, and can usually be prevented if the young cow has the right treatment after her first calf. If she does not show a strong inclination to go dry when within two months of the time she is expected to drop a calf, her feed should be made as light as will keep her in fair flesh, she should be given little or no grain feed, and the milking should be done less thoroughly. Occasionally a cow will be found which will persist in giving milk through the entire gestation period, and in such cases the only thing to be done during the last month is to milk her sufficiently to prevent the udder from becoming caked or inflamed. Any milking during that month beyond what is absolutely necessary for the health of the cow causes a strain on the vitality of the calf, is encouraging a bad tendency, and should be avoided. On the other hand, if the young cow shows an inclination to go dry too soon, every effort should be made to prolong her milking period, which can usually be accomplished by giving her more succulent food and a moderate increase in her grain ration. With nearly all cows the length of subsequent lactation periods is determined by the length of the first period, so it is of the greatest importance that the length of the first period be made as long as possible without crowding the second period too closely.

Calves.—The calf should never be allowed to suck its dam after the first day, and many dairymen never allow a calf to suck at all. Any cow which is worth keeping in a dairy secretes more milk than it is possible for the young calf to use, and the sooner the cow and calf are separated the better for both. When the calf is taken away at once, and the milking is done by hand, the cow soon forgets her offspring and comes to regard the operation of being milked as the natural means of relief for her udder. She will "give down" her milk to the milker as readily as to the calf, the owner can be sure that the udder is completely drained at each milking, and there will be far less danger

from sore teats or a caked bag than when the milker attempts to divide the milking between a headstrong calf and the pail. The calf should always be given the first milk which comes from the cow after it is dropped, but the younger it is when it has its first lesson in drinking from a pail, the easier it can be taught. At first, the milk should be given while it is fresh and warm, and, if it is unusually rich, it should be diluted with warm water. After the calf is two weeks old, a little sweet skim milk may be mixed with the fresh milk, and the amount may be gradually increased until the calf is a month old, when skim milk may be fed alone, though it should be fed warm until the calf begins eating other food. Scours and diarrhea are usually caused by overfeeding or by feeding milk which is too rich. A little strong lime water or baking soda mixed with the milk will usually correct the trouble.

The calf should be kept growing constantly from the time it is dropped until it has reached full size, and this should be done by the aid of all the hay and roughage it can be induced to eat, and with only a small amount of grain. When the growth is made principally on hay and pasture, the calf may become very pot-bellied, but that is in no way objectionable, as a large belly indicates a large development of the digestive organs, and a stomach capable of holding and digesting a large amount of feed is an absolute necessity to every animal which is to become a profitable cow.

If the dam is a grade cow of a small-sized breed and the calf is a male, it is often better to kill the calf as soon as it is dropped; also such pure-blood male calves as are not wanted for service or for sale as breeders. Bull calves of the larger breeds are better worth keeping, at least until they can be made into veal, but the man who makes dairying his principal business will seldom find it profitable to raise and fatten steers.

Heifer calves should be handled very often to keep them gentle, and frequent manipulation of the udder during the first pregnancy will do much to stimulate its development. This frequent handling of the udder is of no little importance, not only in securing its better development, but also to make the heifer so familiar with the operation that when her calf is dropped she will take the milking as a matter of course, and will not require to be "broken." The heifer should be served so that she will drop her first calf when she is about two years old, as breeding when young will make a more productive cow than when the mating is delayed until another year. When the first calf is not dropped until the third year, one calf and one year of milking are lost, and the heifer acquires a tendency to use her surplus feed in the laying on of fat instead of in the secretion of milk—a tendency which will be retained through life and which would have been avoided by earlier breeding.

Testing cows and keeping records.—The first thing which a successful breeder or dairyman must do is to become thoroughly acquainted with every animal in his herd. He must know the amount of milk or butter produced by each cow, and he can learn that only by frequent weighing and testing.

What some records show.—Careful judges estimate that fully one-third of the cows in the country fail to produce sufficient milk to pay the cost of their keep, and that fully 75 per cent of the profits of the dairy business come from not more than 25 per cent of the cows. These results appear in records which have been made at experiment stations, and in so many carefully conducted dairies that they may be accepted as conservative and reliable. At the Georgia experiment station, the best cow in the herd gave 7,968 pounds of milk, which produced butter worth $115.44, while the poorest cow in the same herd gave only 2,788 pounds of milk with a butter value of only $41.63. At the Michigan station the profits on the milk from different cows varied from $6.08 to $94.05. At the New Jersey station the profits from different cows varied from 13 cents to $49.72 when the milk was valued at $1 per 100 pounds. At the Connecticut station the best cow gave a profit of $42.82, while the poorest cow caused a loss of $4.09. In that case the best cow gave a profit nearly three times that of the average cow in the herd. The report in which these figures are published says: "One of the first things our dairymen need to do is to make a closer study of the individual animals of their herds and to reject the unprofitable ones." Professor Farrington, formerly of the Illinois station, gave the results of testing a number of herds as follows:

Creamery value of the milk produced by the best cow and the poorest cow on seven farms in one year.

	Herd No. 1.	Herd No. 2.	Herd No. 3.	Herd No. 4.	Herd No. 5.	Herd No. 6.	Herd No. 7.
Best cow	$82.23	$66.08	$68.16	$58.70	$51.28	$77.21	$48.26
Poorest cow	24.07	47.25	43.79	31.90	28.40	39.32	22.35
Total cows	11	8	5	7	5	11	8

In commenting on this he said:

> Nearly every herd we have tested has proved that some of the cows produce butter enough to pay a handsome profit to the owner, while others that require the same feed, care, and time spent in milking do not make butter enough to pay for the feed they eat. * * * One man who kept twelve cows got more money for the milk of three of the cows than he did for that of all the other nine put together.

Similar records might be multiplied indefinitely. Great as is the difference between the best and the poorest animals in the cases given above, the poorest cows reported are not so poor as are many of those

kept by dairymen who make no accurate tests and who rarely know anything of what each animal is actually doing. When the milk is not weighed the amount is almost sure to be overestimated. An inch or two of froth makes a great difference with the fullness of a pail, though it adds little to the weight of the milk, and the fact that a cow gives three or four gallons of milk in a day at a certain time does not prove that she will give 600 gallons in a year. The cow must be supported during the entire twelve months, and the profit or loss does not depend on what she may do in a day or a month, but on what she will produce during the entire year.

The time and cost of keeping records for each cow are so small as to be only a trifle in comparison with the value of the information gained. Dairymen who have kept such records find that they can weigh the milk of each cow, night and morning, one day in each week, and test it once each month with a Babcock tester, with an expenditure of less than three hours per cow per year. Such weekly weighings and monthly testings will give a very close idea of what a cow is doing. It is only by the keeping of such records that the profitable and unprofitable animals can be distinguished, and the man who keeps such a record will find that he has made many surprising mistakes in his estimates of the relative values of his cows.

FEEDS.[a]

The feed for a cow costs more than half the entire expense for her maintenance, and any saving on this cost adds just so much to her profits. While no saving can be effected by putting her on short rations or by giving feed of inferior quality or unsuitable composition, it is quite possible to make an important reduction in cost by giving just the right kinds of feed—those containing the different food elements in the proportions in which the cow needs them for her own support and for the production of milk. It requires more skill and good judgment to feed economically than to make good butter and cheese. Whether the feed comes from pastures, soiling crops, silos, or grain, it must be abundant, palatable, and nutritious. It is always good economy to provide a cow with as much food as she can be induced to eat without becoming too fat, and a cow which is really a good dairy animal can rarely be made fat while she is giving milk. Pastures give a certain amount of roughage at the lowest cost, but need to be supplemented by soiling crops and silage, while no combination of such feeds will enable a cow to do her best without the addition of more or less concentrated food, like grain. Each one of these sources of feed is so important, and so different in the South from what it is elsewhere, that each needs careful attention.

[a] See Farmers' Bulletin, No. 22, Feeding Farm Animals.

PASTURES.[a]

The least expensive food for a cow is that which she obtains by grazing in a good pasture. By this is meant a field with a fair amount of shade, an abundant supply of good water, and so well covered with good forage that a cow can find all she wants to eat without grazing more than half the time. A good pasture requires a good soil and care in preparation. Soils which are so thin as to be unprofitable for cultivation can often be used to advantage in pasturing young stock and cows which are not giving milk, but no amount of such grazing will make a dairy herd profitable. Lands which are too broken and uneven for plowing can often be made into good pastures, but they must have a fertile soil and receive constant care.

Permanent pastures.—Satisfactory permanent pastures can not be made from any one kind of grass, but must contain a mixture of kinds maturing at different seasons, so that at all times one or more of them will be found at its best. Both true grasses and clovers should be included in the mixture, and no single mixture will be found best for wet and dry, high and low, or clay and sandy lands. Even in a single field there is usually some part on which certain grasses will do better than on other parts of the same field. The soils in the Southern States are so variable that it is useless to give specific directions for seeding a permanent pasture, as the planting must vary with the soil and location.

In general, Bermuda is the best grass for the foundation, and to that should be added whatever can be made to grow. On low ground, especially if subject to overflow, redtop, water grass (Paspalums), and Alsike clover will be valuable additions, while on the drier soils orchard grass and lespedeza should be added. On soil strong in lime melilotus makes a valuable addition to the amount of grazing. White clover does well on a soil not too dry, and bur clover often makes a fine growth in early spring when sown on Bermuda sod. On the sandy soils near the Gulf coast Bermuda is largely replaced by carpet grass, which has the merits of growing well on very light soils and of bearing moderate frosts without injury. While the native pastures in the South consist largely of wire grasses, broom sedges, and the like, those which are on rich soils improve by use, and in a few years the native species are replaced by the smaller-growing but more valuable carpet grass and Bermuda. Dr. Knapp, of Lake Charles, La., states that while the natural pastures in that region will support only about one cow to 3 acres, some older pastures will support a cow to 1 acre, and that he has kept three cows per acre in good condition during nine months of the year. On the rich alluvial soils along the larger rivers, where Bermuda is at its best, there are many pastures which will support two cows per acre during the summer, and Col. F. L. Maxwell, of Mound, La., states that he has kept ten cows per

[a] See Farmers' Bulletin No. 102, Southern Forage Plants.

acre in good condition from May to September; but such results are possible only on the richest of soils.

Temporary pastures.—Even with the best of management and the wisest selection of varieties, it is a difficult matter to make and maintain a permanent pasture which is entirely satisfactory to the dairyman, and many find it more profitable to depend principally on temporary pastures for summer grazing. The long growing season in the South makes such pastures much easier to provide and much more profitable than in a region where the growing season is so short that but one crop can be grown on the ground annually. Here, by using a right succession of crops and by making successive sowings, it is quite possible to secure fair grazing from March and really good grazing from the first of May until heavy frosts in October or November. In early spring, turf oats, hairy vetch, wheat, rye, and crimson clover will cover the time from the first warm weather until the last of May, and by that time the natural pastures are at their best. Cowpeas, rice, sowed corn, and sorghum will furnish excellent grazing through the usual midsummer drought when the permanent pastures are becoming dry and withered. Successive sowings of these crops will furnish feed until corn is ripe, when the gleanings of the fields will give the best of feed. Crowfoot and crab grass, Mexican clover, beggar weed, and other volunteer forage plants quickly cover every Southern field soon after cultivation ceases for the season, and these make rich grazing on lands from which oats, wheat, potatoes, melons, and other early crops have been removed; and even the cornfields, from which the stalks have been cut for fodder, yield abundant and succulent grazing during the late fall months. Of course, every dairyman should grow cowpeas for hay whenever practicable, and the pickings of a field from which such a crop has been harvested make grazing of a quality which soon shows itself in an increased flow of milk.

These temporary pastures of annuals and "catch crops" require forethought and careful planning to make the feed supply continuous, and considerable fencing is needed to separate the fields and to divide single fields into sections so that the feed need not be trampled and wasted; but careful planning will enable one to maintain a constant succession of rich grazing from the time when vetch, crimson clover, and oats begin their early spring growth until the fall frosts have killed the late peas, beggar weeds, and crab grass.

SOILING CROPS.

Soiling is often more economical than grazing, especially where land is expensive, as it enables one to keep about three times the number of cows on the same area. There are few permanent pastures which yield good grazing for more than one cow to two acres for eight months. Temporary pastures, such as have been mentioned above,

should pasture two cows per acre for from two to four weeks on each crop, while soiling crops will feed from three to five cows per acre during the entire growing season. One dairyman at Harmony, Ga., states that he keeps an average of five cows per acre on his soiling crops, while another dairyman near Atlanta states that he kept 25 milch cows in good condition from the middle of June until the last of September by the use of Amber cane cut from 2½ acres of land.

A profitable soiling crop requires a rich soil in good condition, and the fields should be very near the feeding lots; but, as a dairy herd always furnishes a good supply of stable manure, it is a simple matter to make the soil rich and to keep it in a constantly improving condition. While the character of the feed from soiling crops is practically the same as that from temporary pastures, it is used much more economically, as it is gathered only as needed, and is gathered without injury to the roots, so that the plants make a second growth much more readily than when grazed and trampled. The most productive soiling crops are oats and vetch for April and May, alfalfa and Johnson grass for May and June, alfalfa and sorghum from June to October. On the light soils near the coast, vetches do not succeed as well as on heavier soils, but this is largely made up for by the longer growing season for alfalfa and the earlier maturity of other crops. On rich soil in the extreme South teosinte makes a heavier growth than does any other forage plant. Many prefer rye or wheat to oats for early soiling, while rice is valued highly in the sections where grown. Many other crops are used to a greater or less extent, and as cows do better on a variety of feeds it is always good policy to have as many different forage crops as can be arranged for without too much expense. German millet will be ready for cutting in about five weeks from the time the seed is sown and the green forage makes good soiling material, but dry millet hay is not specially desirable. Velvet beans make a heavy yield of rich feed, cowpeas are always desirable, and sweet potato vines will do more than almost any other green feed to stimulate a flow of milk after the yield has dropped off during a late summer drought.

SILAGE.

A silo[a] is almost indispensable to economical and successful feeding. The best natural food of a cow is fresh herbage, and when she is deprived of it she soon shows the effect by a sharp decrease in her yield of milk. This falling off is sometimes as much as 25 per cent in a week, an unnecessary loss, which can be prevented by maintaining a constant supply of succulent feed. In the South the silo is often more needed in a midsummer drought than at any other time, and is often more profitable in July than in January. With the best of manage-

[a] See Farmers' Bulletin No. 32, Silos and silage.

ment, pastures and soiling crops sometimes fail for a few weeks, as during the unprecedented drought of 1901. At that time the milk from every Southern dairy which depended on pastures or soiling crops fell off fully one-half, while those dairymen who had filled their silos in June were able to supply their customers as usual. If a dairyman could be sure of really good pastures and a constant succession of soiling crops for the entire year, a silo would not be needed, but the most successful dairymen, and those who have had the most experience in its use, are the most emphatic in its favor and rely on it with increasing confidence. The cost of building a silo will usually be from one to two dollars per ton of its capacity, and the larger it is the less the cost per cubic foot for its contents. It is not generally profitable to build silos and purchase the machinery necessary for cutting the silage for a herd containing less than 12 or 15 cows. The round form is now the more popular shape, as it is less expensive to build and exposes less surface to the air than the old square form. It is seldom economical to build one less than 10 feet in diameter and 18 feet in depth, while 16 feet in diameter and 30 feet in depth is a common and convenient size.

Corn and sorghum are the crops most commonly used in filling a silo, corn being the general favorite. When grown for this purpose, it should be planted in rows and a little closer than usual, so as to crowd the stalks and prevent them from becoming too large and coarse, but not close enough to prevent most of them from forming ears. Cutting should begin as soon as the grain begins to glaze, and the crop should be placed in the silo as fast as it is cut. No advantage is secured by allowing it to wilt in the field, and if allowed to become too dry it fails to pack closely in the silo and is more liable to decay. If the work must be done in rainy weather it is well to let the stalks lie a few hours to drain off the outside moisture, but the leaves should not become wilted. On good soil the yield is from 10 to 12 tons per acre, though much heavier yields are secured when the crop is grown on very rich soil and in a favorable season.

Sorghum may be cut when the heads are well out, and the cutting should be finished before the seeds become hard. While the yield is often greater than that of corn, it is not as well liked by most dairymen, as the greater amount of sugar in its juice makes the silage more acid, and it is sometimes claimed that it gives an unpleasant flavor to the milk. Any such flavor may be avoided, however, by feeding the silage after milking instead of before. Many attempts have been made to make a silage of corn and cowpeas grown together, and when the attempts have been successful the results have been highly satisfactory. The difficulty in growing such a crop is in securing a growth of pea vines which is of sufficient weight and bulk to be of value, and at the same time not so rampant as to tangle the corn, pull it down,

and make it hard to handle. Probably the best growths have been secured when "whip-poor-will" peas have been planted in the corn rows when the corn was about a foot high. When grown in that way many of the pea vines will reach the tops of the corn stalks and will mature a considerable number of pods by the time the corn is in condition for cutting.

Soy beans, alfalfa, melilotus, red clover, and other crops make good silage, but their yield is so much less than that of corn or sorghum that they are seldom used. Silage made from any of the legumes is more valuable, ton for ton, than is that made from other crops, and when they can be mixed with the crops commonly used they add largely to both the palatability and the feeding value of the silage. The cost of raising a crop of corn or sorghum and putting it into a silo ranges from 30 to 75 cents per ton, the expense varying with the yield per acre, the distance of hauling, and the conveniences for doing the work.

CROPS FOR HAY AND OTHER CURED FORAGE.

Although succulent feed is needed to produce the best flow of milk, more or less hay must be used in every dairy, and the large number of hay plants[a] which grow well in the South make a wide range of selection possible, and make it practicable to grow several kinds on almost every farm.

Grasses.—Among the true grasses, Bermuda is used more largely than is any other, as it grows well on rich soils in all sections, makes a heavy yield, and the hay has such slender stems and fine leaves that there is little waste in feeding. Johnson grass makes a heavier yield than Bermuda, and, when cut at the right time, a better hay. It grows easily from seed or from the thick and fleshy rootstocks, is difficult to eradicate when once established in a field, and is liable to spread to other fields where it is not wanted. While it seldom becomes a troublesome weed on sandy soils, it is practically permanent when it becomes set on heavy soils, such as are found in the black prairie regions of Alabama, Mississippi, and Texas. When it has gained a good hold on a farm where the soil is suited to its growth, the dairyman should make up his mind to utilize it rather than to waste time and strength in a fruitless endeavor to destroy it, and he will find it his best and most productive hay plant. As many of the ripened seeds will pass through the digestive organs of a cow without being injured, the grass should be cut early, or the manure may spread it to other fields.

Wheat, oats, and corn fodder.—Excellent hay is made from oats and wheat which have been used for winter grazing, and which are cut when the grain is in the milk or a few days earlier. Such hay can be made at a small expense, as it is grown during the winter months when

[a] See Farmers' Bulletin No. 102, Southern Forage Plants.

the land is not needed for other purposes, and the value of the winter grazing more than pays the cost of the crop. Corn fodder is used to some extent, but is valued less highly than in the North, as it is usually possible to secure an equal amount of feed from other crops at a less expense than the cost of cutting and handling the stalks. Cornstalks often grow so large and coarse that they become too hard and woody to be palatable unless they are shredded. When the corn is in condition for cutting the field is usually covered with a growth of cowpeas which would be seriously injured by cutting the corn, and which is worth far more than the stalks for the production of milk. When the fields are grazed soon after the corn is gathered the more tender and better parts of the stalks, together with a good part of the leaves, will be eaten, so the real loss of palatable forage is not so great as where the growth of the plant is so slender that the entire stalk can be eaten. Shredded cornstalks makes a feed of excellent quality; if the stalks are good and bright when harvested it is quite equal to average mixed hay, ton for ton. A considerable number of shredders are now owned in the Southern States, and this method of preparing the corn plant is very highly recommended by those having experience as economical and satisfactory.

Leguminous hay crops.—Among the leguminous plants for hay the cowpea[a] undoubtedly makes the best and cheapest. The crop is one which makes a heavy yield per acre, which can be grown during any two months of warm weather, and which is so rich in protein that only a small amount of grain need be fed with it. In fact, the readiness with which the cowpea adapts itself to any soil, the certainty with which a crop can be secured even in the most unfavorable seasons, and its very high quality as a feed for milch cows go far to make dairying a profitable business wherever the crop is given reasonable attention.

Soy beans[b] are similar to cowpeas in character, but do not make as palatable a hay on account of their coarser and heavier stalks, though their heavier yield of seed is a partial compensation for the poorer quality of the hay. Alfalfa is productive and satisfactory wherever it can be grown, but makes a profitable yield only on soils which are rich, in good mechanical condition, and have an open subsoil. Melilotus is very similar to alfalfa in quality and makes a thrifty growth on soil rich in lime, though of little value elsewhere. It grows well on many soils entirely unsuited to alfalfa, and, when grown mixed with Johnson grass, it adds largely to the total yield, and makes a decided improvement in the quality of the hay. Cowpeas may also be used profitably in Johnson grass meadows.

Cotton-seed hulls are used quite largely as a substitute for hay, and

[a] See Farmers' Bulletin No. 89, Cowpeas.

[b] See Farmers' Bulletin No. 58, The Soy Bean as a Forage Crop.

their use is often good economy. They have a feeding value equal to that of a rather poor hay, and so must be fed in connection with a large amount of grain to make the ration what it should be. They are very good for use as a dry feed in conjunction with silage, and as they can usually be purchased for from $4 to $6 per ton, they make an inexpensive feed.

GRAIN FEEDS.

Cotton-seed[a] meal is the cheapest and best grain feed which the Southern dairyman can use, but at the same time the most dangerous. It is ordinarily sold for a less price than an equivalent of concentrated food can be purchased in any other form; it is richer in protein than is any other feed; and it has a marked effect in hardening and raising the melting point of the butter. But when fed in excess it is most disastrous in its effects, causing derangements of the bowels, a tendency to abortion in cows, and impotency in bulls. Containing as it does from 40 to 45 per cent of protein, the element most needed in the production of blood, muscle, and milk, it is the richest grain feed we have, and one which can not be wholly replaced at an equal expense by any other feed. It contains more than four times the amount of protein found in corn meal, nearly three times as much as in wheat bran or shorts, and double the amount in pea meal or malt sprouts. It follows, naturally, that a feed so rich must be used with extreme care, though the relatively low price for which it can be bought makes its use, up to the limit of safety, an essential part of economical feeding. The amount which can be used with safety varies with different animals, the season, and the length of time it is used. Three pounds daily is as much as should be used in the feeding of an average cow, though individual animals may be able to consume as much as 5 pounds daily through the entire season and suffer no ill effects. More can be fed in winter than in summer, and many successful dairymen practice giving 4 pounds daily from the time full grain feeding begins in the fall until the spring pastures become good, when the amount is reduced to 2 pounds daily for the summer season. From 5 to 6 pounds are often fed daily for a few days or weeks with evident good results, but such heavy feeding can rarely be continued many weeks, and should never be practiced when the cow is advanced in pregnancy.

Cotton seed is used to some extent in feeding, but has proven less satisfactory than the meal. When fed in small amounts, from 5 to 6 pounds daily, it is worth about one-half its weight in meal, but it contains such a large amount of oil that it must be used with great caution. Numerous devices for cooking, roasting, and steaming have been tried, and, while cooking improves its quality, no particular advantage results; and so long as the present relative values of the seed and the meal are maintained the meal will be cheaper.

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[a] See Farmers' Bulletin No. 36, Cotton Seed and Its Products.

Wheat bran, shorts, and corn meal are the grain feeds most commonly used to supplement cotton-seed meal, though malt sprouts, ship stuff, and rice polish are often used. Of these, wheat bran and shorts are usually to be preferred when the cost is not too great, and in most cases the food contained in them costs less than in the other feeds mentioned. Both are rich in protein, containing from 14 to 17 per cent of that element, and so are specially valuable for inducing a full flow of milk. Corn meal usually costs nearly as much per ton as does wheat bran, and, being rich in carbonaceous elements, is more valuable for fattening purposes than for milk production, though it can often be used to great advantage for mixing with cotton-seed meal to reduce the excessive proportion of protein in the latter. It is also very useful when the cows are fed mainly on pea vines, alfalfa, lespedeza, or other leguminous hay.

Rice bran and rice polish are intermediate between wheat bran and corn meal in their composition; but they are produced in such limited quantities that their use is confined almost wholly to the immediate neighborhood of the rice mills in the rice-growing districts of the Carolinas and Louisiana. Ship stuff, made from wheat screenings with more or less corn, is very variable in its composition, but is always low in its protein content, and so is more valuable for mixing with cotton-seed meal than for feeding by itself.

FEEDING.

The economical feeding of dairy cows[a] requires more skill, knowledge, and attention than does the production of the food. No two foods are alike in their composition or effects, and no two cows are alike in their preferences for different foods, in their requirements for producing a maximum yield of milk, or in their digestive ability. Economical feeding requires that the cow should be given all the palatable food which she can be induced to eat and is able to assimilate; and that this food should contain the different nutritive elements in the proportions in which they are needed to sustain life and produce milk. Although no definite rule can be made by which every animal may be fed, there are a few well-established principles with which every feeder should be familiar.

Amounts of nutrients required.—Tests, which have been duplicated hundreds of times and in which thousands of animals have been used, show that a cow weighing 1,000 pounds needs the equivalent of about 25 pounds of dry food daily, and that this food should contain about 13 pounds of carbohydrates or starchy matter, from half a pound to 1 pound of fat, and from 1½ to 2½ pounds of protein. By dry food is meant food free from water, and when fresh food like soiling crops and silage are used, the total weight must be increased to make up for

[a] See Farmers' Bulletin No. 22, Feeding Farm Animals.

the moisture, as, for instance, 100 pounds of silage contains only about 25 pounds of dry food. The great problem of the feeder is to learn how he can mix his different materials so as to form a feed of the best composition—a balanced ration—at the least cost.

Sources of nutrients.—Protein is by far the most expensive element in a ration, and so is the one which should receive the closest attention. It is the element most needed in the development of blood and muscle and for the production of the casein or curd in milk. Starchy or carbonaceous elements form the principal digestible portions of hay and silage made from the true grasses, and of some grains—as corn, rice, barley, and rye—all of which are poor in protein; but hay made from cowpeas, lespedeza, the clovers, alfalfa, and other legumes, and such grain feeds as cotton-seed meal, wheat bran and shorts, pea meal, malt sprouts, and brewers' grains contain a much larger proportion of protein.

The mixing of feeds.—The problem of the feeder, then, is to mix these different foods so that the whole will have the proper bulk and weight and contain the different nutritive elements in the right proportions. This problem is one which is not always easy to solve, and is made still more difficult by the fact that cows differ in their requirements with the season, the amount of milk which they give, and the period of gestation. Although the problem may not be capable of an exact solution, it is quite possible to approximate very closely.

There are few feeds of which a cow can eat 25 pounds daily which do not contain all the carbonaceous material which she needs, so that in making up a ration the feeder needs to give little attention to anything beyond palatability, bulk, and the proportion of protein. As protein is costly and, when fed in excess of the requirements of the cow is worth no more than the cheaper carbonaceous elements, no more should be given than is necessary for the maintenance of the cow and for her secretion of milk. While an excess of protein in the feed does no special harm any deficiency will be shown very quickly in the decreased flow of milk. Some kinds of hay, like that made from pea vines for instance, contain as large a proportion of protein as is needed, but most cows do better when a part of their rations consists of concentrated feed, like grain or meal, and it is usually better to use at least a small amount of such food even with a hay rich in protein. Pea-vine hay contains about the same proportion of digestible protein which is found in wheat bran, but a cow will do better on a daily ration of 20 pounds of the hay and 5 pounds of bran than on 25 pounds of either the hay or the bran fed alone. Bulk of feed is necessary to stimulate the digestive organs of the cow and keep them in good condition, and digestion seems to be still further stimulated by the addition of some concentrated grain food to the bulky hay ration.

In some cases it is advisable to use a feed in which the different food elements are not in exactly the proportions in which they are assimilated by the cow. Local markets may make a certain feed very cheap or unduly expensive, and on every farm there is always a certain amount of food produced which is of high value for milch cows but which can not be sold or exchanged for other feeds. Gleaning a cornfield in which cowpeas have been grown or pasturing on vetch will give a cow more protein than she needs, but still is an economical feed. It often pays a dairyman to sell a portion of the grain which he has grown and purchase other feed in its place.

Comparison of feeds.—Hay is always less expensive than grain, and in buying and using grain the dairyman should be guided principally by the amount of protein which it contains. The amount of digestible protein in some of the common grain foods, and its cost when the feed is valued for that alone, is shown in the following table, the prices per ton for the several feeds being about the present average prices in the Gulf States:

Comparison of grain feeds on basis of protein content.

Kind of feed.	Price per ton.	Digestible protein per ton.	Cost per pound of digestible protein.
	Dollars.	*Pounds.*	*Cents.*
Cotton-seed meal	22	740.2	3
Cotton seed	15	221.6	6.77
Corn meal	25	140.2	17.6
Ground corn and oats	25	147.8	16.9
Wheat bran	22	240.2	9.2
Wheat shorts	24	244.4	9.8

It will be seen that when protein is purchased in cotton-seed meal it costs much less than in any other feed, but, unfortunately, it is not safe to feed enough of the meal to furnish all the protein needed, so a part of the supply must come from other sources. When hay from any of the legumes is fed, the grain feed used may be rather poor in protein, like ground corn or rice polish which will add to the carbonaceous elements; but with silage, corn fodder, or hay made from any of the true grasses, wheat bran will usually be more profitable. Cotton-seed meal may be used to furnish about 1 pound of the needed protein, but the balance should come from hay or from some other grain.

Rules for feeding.—The old rule for feeding was to give 1 pound of grain per day for each 100 pounds of live weight of the cow, but that rule was defective in that it gave to a cow in full flow of milk no more than to a dry cow of equal weight. Many feeders have now adopted the rule of giving 1 pound of grain per day for each pound of butter made in a week; thus a cow making 6 pounds of butter in a week would receive 6 pounds of grain daily, while the cow giving

10 pounds of butter weekly would receive 10 pounds of grain as her daily ration. This is much better than feeding cows according to weight and regardless of production, but still it should not be adhered to too strictly, nor should all cows receive the same kind of grain. A cow which is thin in flesh should be given a fattening grain, like corn, a feed which should be avoided for a cow which is inclined to become too fat.

What is known as a balanced ration—one in which the protein bears the proportion to the carbohydrates necessary for the best results—will undoubtedly support the cow on a smaller amount of food than will a ration in which either element is in excess, but feeders are not wholly agreed on what the proportion should be. For many years the rule was to give a feed containing 1 part of digestible protein for each 5.4 parts of digestible carbohydrates, or, as it is commonly stated, a ration having a nutritive ratio of 1 to 5.4. Recent experimental work has shown the economy of varying the proportions with the condition of the animal, and has led to a general practice of feeding less protein to cows nearly dry, and more to those producing a heavy flow of milk. What is known as the Wolff-Lehmann standard[a] is as follows:

The Wolff-Lehmann feeding standard for dairy cows.

Milch cows.	Total dry matter.	Digestible nutrients.			Nutritive ratio 1 to—
		Protein.	Carbohydrates.	Fats.	
When yielding daily—	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	
4 quarts of milk	24	1.6	10	0.3	6.7
8 quarts of milk	27	2.0	11	.4	6.0
12 quarts of milk	29	2.5	13	.5	5.7
14 quarts of milk	32	3.3	13	.8	4.5

Rations fed in the South.—In the South the most common and least expensive feeds are the Bermuda, Johnson, and crab grasses, cotton-seed hulls, silage, and pea-vine, alfalfa, and clover hays. Of these the first 5 are poor in protein, while the last 3 are rich in that expensive element. The cheapest grain feeds are cotton-seed meal, cotton seed, and wheat bran. Of course there are many other feeds, such as corn fodder, oat straw, sorghum, rice hulls, turnips, sweet potatoes, etc., which are often used, but fully four-fifths of the milch cows in the South are fed on the 5 coarse feeds and the 3 grain feeds named above. With almost any two or three of these a satisfactory and fairly well-balanced ration may be made. Some of those in actual use by Southern feeders are as follows:

[a] Henry: Feeds and Feeding, pp. 101–111.

Some rations fed in Southern dairies.

	Pounds.
No. 1:	
Silage	40
Pea-vine hay	15
Cotton-seed meal	3
No. 2:	
Silage	24
Clover hay	16
Shorts	8
No. 3:	
Silage	40
Grass hay	12
Cotton-seed meal	4
No. 4:	
Clover hay	20
Cotton-seed meal	3
Wheat bran	4
No. 5:	
Silage	24
Pea-vine hay	16
Wheat bran	8
No. 6:	
Clover hay	20
Wheat bran	8
No. 7:	
Silage	24
Pea-vine hay	20
Cotton-seed meal	4
No. 8:	
Pea-vine hay	20
Cotton-seed meal	3
Wheat bran	6

It will be noticed that 4 pounds of cotton-seed meal is often included in the ration, but in such cases that amount is given only during the winter, the summer ration being only about 2 pounds of the meal daily. In making up the ration it should be remembered that no change in the feed will make any material or permanent difference in the richness of the milk, though it may have a marked effect on its quantity and flavor.

It may be taken as an invariable rule that hay, no matter whether it be from the true grasses or from some leguminous crop, should be fed *ad libitum;* and it is generally true that it is good economy to add to the hay ration as much grain as the cow will eat and properly digest. When a cow shows any indication of scouring or other digestive trouble her grain feed should be cut down, but she should always have all the hay she will eat, no matter whether her ration "balances" or not. The feeder must watch each animal in the herd and feed to her individual needs if he wishes to secure the best results.

Salt should always be kept in a place where the cows can go to it at will.

UTENSILS.

Kind and quality.—Whatever utensils are used should be of good quality and, when possible, of metal rather than of wood. Milk pails, cans, strainers, dippers, etc., should be of heavy tin, well soldered. Seamless pressed utensils are best, and when such can not be secured all seams should be examined carefully to see that the joints are perfectly smooth, with no sharp angles or cracks in which dirt will gather, where it can not be easily removed. All interior parts should be easily reached and, if possible, so arranged that they can be seen. Half the success in keeping milk sweet and in making good butter depends on the use of perfectly clean utensils. Rough solder-

ing, creases, narrow openings, and sharp corners should always be avoided. The churn, butter worker, and any other wooden utensils should be made of close-grained wood which will absorb very little moisture, and should be plain and smooth. The churn should be of the simplest description, some of the box or barrel forms being much better than any of those having inside fixtures which revolve. The churn should be so large that it will not be filled more than one-third or one-half full at each churning, and the opening should be so large that it can be readily cleaned.

Where milk is handled in considerable quantities it will pay to use a regular aerator, of which there are several styles on the market, though nearly all of them work on the same principle and accomplish both aeration and cooling at the same time. The milk is made to flow slowly in a thin layer over a large cool surface. Some of these aerators are made with a corrugated surface, something like a washboard, and are so arranged that a stream of cold water is run upward through the inside to keep the surface cool.

Care of utensils.—The care and cleaning of the dairy utensils is an important part of the work, and a part which is too often slighted. Everything about the dairy should be thoroughly cleaned at least once each day, and the more promptly the work is done the easier it will be. It is easy to remove fresh milk, but utensils in which milk has been allowed to dry and perhaps become sour and rancid require many times more labor to put them in fit condition for use. If utensils can not be cleaned immediately after they are used, they should be filled or put into water, so that they will not become dry.

Thorough cleaning can not be secured without a liberal use of hot water, and steam makes the work much easier, as well as more satisfactory. The vessels which have contained milk should first be rinsed with cold or slightly warm water, as hot water coagulates the albumen, making it stick to the vessels and difficult to remove. They should then be washed thoroughly with very hot water, to which sal soda or some similar cleaning material has been added. A brush with a handle is much better than a cloth or a sponge for this washing, and should be made to reach every part of the surface, special care being taken that all seams and angles are scoured until perfectly clean. After this scrubbing with the brush they should be rinsed to remove all traces of soap or soda, and the work will then be much better done if they are exposed for a few minutes to a jet of hot steam. Most utensils dry very quickly after such a steaming, and should be kept in a room which is free from dust. If steam is not available, they should be wiped dry immediately after the final scalding and, if convenient, placed in the sunshine.

As a good supply of hot water is always needed, it costs little more to provide for steam also, even when it is not used to run a separator

or churn. Hot steam under a very light pressure can be made to reach every part of all utensils, and is one of the best disinfectants known. Its use not only saves labor in the cleaning, but it also does much to secure milk and cream which are free from taint or bacteria. A small boiler, costing not more than $25, can be arranged so that it will not only furnish all the hot water needed, but the steam also. Even some of the ordinary feed cookers may be used for the purpose in a small dairy.

THE SEPARATOR.

A separator will pay in any dairy where butter is made from 10 or more cows. When cream is taken by the most careful setting of milk, either in shallow pans or in deep cans, too much of the butter fat is left in the skim milk, while a separator will leave scarcely any. The difference will in a short time amount to enough to pay for a separator costing from $75 to $125, to say nothing of the increased value of the skim milk, while the labor of running and caring for a separator is far less than that required for setting and skimming the milk and cleaning the pans. Hand separators do good work, and all excepting the smallest sizes are made so that they can be run by power when desired. A small tread power is all that is needed for a separator capable of handling 400 to 600 pounds of milk per hour, and the running of it is an excellent way to make the bull pay his board. The use of a separator effects such a great saving of ice that it is even more profitable in the South than in the North, where ice is less expensive and cold springs are more abundant.

Many dairymen who sell milk to city consumers find it profitable to use a separator, not for removing a portion of the cream, but to secure milk which is of uniform richness, and for removing any impurities it may contain. Even the finest of strainers fail to remove dirt from milk as thoroughly as it is done by a separator, and those dairymen who furnish the purest and most uniform milk will always secure the best trade.

HANDLING THE MILK.

Keeping the milk clean.—Milk should be handled with the greatest care and cleanliness from the time it leaves the cow until it reaches the customer.[a] The specks of dirt, hair, and other filth which accumulate on the strainer show the necessity for care in milking. The cleaning of the stalls and the feeding of the cows should be done at least half an hour before the milking is begun, in order to give time for all dust to settle. The milker should brush the flanks and udder of each cow before milking, and much less dirt will fall into the pail if the udder is wiped off with a damp cloth. Milk should never be

[a] See Farmers' Bulletin No. 63, Care of Milk on the Farm.

allowed to stand in the stable after it is drawn, but each pail should be taken to the milk room as soon as it is filled, and strained by running it through a strainer with a fine wire gauze, for removing the coarser particles of dirt, and then through several thicknesses of cheese cloth or a layer of cotton to remove the finer particles. If the milk is to be run through a separator it should then go to the supply tank and the separator should be started at once, so that the milk will be separated while still warm. As soon as it is separated, or as soon as it is strained if it is not to be separated, it should be aerated and cooled as quickly as possible.

Aeration and cooling.—Aeration is of great importance for all milk except, perhaps, that which is to be used at once for butter or cheese, or is to be taken immediately to a factory, as it not only cools it quickly, but does much to remove any "cowey" or other disagreeable odors which may be present, and which have been caused by the feed or the condition of the cow. Many Southern pastures are badly infested with "bitterweed," while others have more or less wild garlic, either of which will quickly give the milk an unpleasant taste. These tastes and flavors imparted by weeds and peculiar foods can be considerably reduced by aeration, and there are some specifics in the market which will almost overcome these evils, if not wholly prevent them. An active stirring and splashing of the milk while it is cooling will do much to aerate it, and still better results can be secured by pouring it slowly several times from 2 or 3 feet above the receiver. A milk pail with a number of small holes in the bottom does well for this work. There are a number of appliances on the market for use in cooling and aerating milk. These are effective and not expensive. Such a cooler and aerator does the work better and quicker than it can be accomplished in any other way. The warmer and fresher the milk when it is aerated, the more thoroughly will its foreign odors be removed.

PASTEURIZING.

The pasteurization of milk consists in heating it to a temperature of from 140° to 150° F., keeping it at that temperature from ten to thirty minutes and then cooling it very rapidly to a temperature of 50° F. or less. Repeated tests and bacteriological examinations at the Wisconsin, Illinois, and other experiment stations show that the tubercle bacillus, as well as most other deleterious species of bacteria, may be rendered harmless by this treatment, while it does not give the "boiled" flavor which follows the heating of milk to a higher temperature, and which is disagreeable to many. Milk which has been pasteurized will remain sweet several hours longer than that which has not been so treated, which adds much to its value, especially when shipped to a city market in warm weather. If pasteurizing is done in open vessels the milk must be stirred frequently to prevent the

formation of a thin film over the surface. In whatever way the milk may be heated, it must be remembered that rapid cooling is an essential part of pasteurizing. Heating to the temperature necessary for killing germs and then cooling slowly does very little good. When milk is to be both pasteurized and separated it may be heated first and run through the separator while at a high temperature. The cream or milk should be immediately run over an aerator and then placed in cans in cold water and frequently stirred until cold. If the milk is to be sold in bottles it should be bottled directly from the aerator, the filled bottles closed immediately and put in a suitable place for cooling.

SELLING MILK.

When milk is to be shipped by rail it is usually run directly from the cooler and aerator, or from the strainer if it is not aerated, into the cans in which it is to be shipped. If a cooler is not used, cooling is sometimes hastened by putting a piece of ice into each can, but this is an objectionable practice. It is much better to cool the cans by setting them in tanks of cold water and stirring the contents a few times while cooling, and the milk will reach the market in a much better condition if each can is covered with a jacket to protect it from extreme heat or cold.

When milk is to be sold from a wagon it always pays well to have the wagon, horse, harness, cans, and driver present a neat and attractive appearance. No one likes to take milk from rusty cans, to have it measured in a dirty cup, or handled by a man with dirty hands or clothes. Keeping the entire outfit clean and neat pays better than does any other part of the dairy work in securing and holding a good trade. The delivery of milk in sealed jars or bottles has become very common in recent years, and the method has advantages for both dealer and consumer, although it entails some additional labor on the former.

Some customers will want to secure milk regularly from the same cow for feeding an infant. Such customers should be accommodated if they insist and are ready to pay an extra price; but it is now generally agreed that it is better to give infants the mixed milk from a herd than the milk from one cow. In larger towns there is likely to be a considerable demand for pasteurized milk. Pasteurizing costs something, and the selling price of the milk should be increased sufficiently to give a fair profit on the increased cost.

BUTTER MAKING.

In the South the manufacture of butter is usually more profitable than is the making of cheese. The long summers make the curing of cheese a somewhat difficult matter, and the local demand for butter is such that the product finds a ready sale as soon as made. Really good

butter is a scarce article in all parts of the South, and the market for it will not be overstocked for many years to come.

The essentials for making good butter[a] are good milk, clean utensils, a place where the cream can be kept and ripened at the proper temperature, an abundance of pure cold water from spring or well, or an ice supply, and good judgment in churning and working.

CREAMING THE MILK.

Whether the creaming is done by setting the milk in shallow pans or in deep cans or removing by a separator makes no difference with the quality of the butter, though a separator will secure a much larger amount than can be secured by any method of setting. If the cream is to be gathered by setting the milk, and the temperature of the room can not be kept fairly uniform at or below 50° F., it will usually be best to set it in the old-fashioned shallow pans in which it will not be more than 2 or 3 inches deep. The room in which it is set should be cool, and the air pure and free from disagreeable odors. A room adjoining the kitchen is often so filled with steam and odors from cooking as to be an unfit place for keeping milk, and is sure to be too warm in summer and too cold in winter. An ordinary cellar has a more uniform temperature, but if not well ventilated is sure to give a musty and earthy flavor to the butter. A cellar ventilated and cooled by the subearth duct described on page 15 is usually the best milk room which can be arranged where a cold spring is not available.

If the temperature of the room can be kept as low as 60° F. the milk can stand in the shallow pans from twenty-four to thirty-six hours, and the creaming will then be quite complete. If the temperature is much above 60° F. the milk is almost sure to become soured and thickened before all the cream has risen. If the room becomes too cold, as it often does in winter, thorough creaming may be secured by heating the milk to a little above blood heat before setting, and allowing the cream additional time to rise while the milk is cooling. The ordinary 10-quart pans can be heated very quickly by placing them over a kettle of hot water.

In what is known as "deep cold-setting" the milk is set in cans about 20 inches deep and 8 inches in diameter. When this method is followed the setting should be done promptly while the milk is still warm, and the temperature should be reduced to as nearly 40° F. as possible and held there, though very good results may be secured with a temperature of even 50° to 55° F. This low temperature may be secured by placing the cans in tanks of ice water, or in a cold spring, care being taken that the water stands a little higher than the top of the milk in the cans, so that there will be no layer of warm milk left on the sur-

[a] See Farmers' Bulletin No. 57, Butter Making on the Farm.

face. This deep setting is not often satisfactory without the use of a liberal supply of water, as such setting in cold air, no matter how low the temperature, fails to secure effective creaming. It is most useful in dairies where a cold spring house can be used for the milk room, or where the cans can be surrounded by a stream of water from a flowing well. It is claimed that the creaming in deep cans is more thorough than in shallow pans, and the cans require less space than pans; but where the necessary water supply is not available pans will give the better results.

RIPENING THE CREAM.

The time and temperature for ripening the cream will depend on how the cream was gathered. Cream from shallow pans is partially or wholly ripened when it is gathered; in fact it may sometimes be overripened. When so little butter is made that it is not necessary to churn every day the cream may be kept in a can or an earthenware jar in a cool place, and should be thoroughly stirred whenever more cream is added. When a sufficient amount is accumulated, in from two to four days, it needs only to be brought to the proper temperature to be ready for churning.

When deep setting is practiced the cream is sweet when gathered, and must be ripened before it is churned. Several skimmings may be put into the same can, as in shallow setting, though none should be added less than 12 to 16 hours before churning, or the ripening will be uneven. In order to ripen this cream it should be kept at a temperature of from 60° to 70° F. for from 24 to 36 hours before churning, or the ripening process may be hastened somewhat by using a "starter" of buttermilk from the last churning. Buttermilk which is used as a starter should be the first which is drawn from the churn, and should be kept in a sealed glass jar in the coolest place available. About one-half pint of the starter is added for each gallon of the cream when it is desired to begin the ripening. Some butter makers secure the advantages of a starter by ripening the cream in a churn which is never washed. Although that method doubtless hastens the ripening of the cream very greatly, it is impossible to make finely flavored butter or butter which will be free from lumps and specks when the remains of all previous churnings are allowed to dry, ferment, or decay on the sides of the churn. Besides, this method is impracticable unless churning is done daily.

If the cream comes from a separator, of course it will still be warm and perfectly sweet when gathered, and should at once be ripened like the cream from deep setting, though it requires from 6 to 12 hours more time.

The degree of ripening and the length of time required for the process can not well be described, as they are influenced by the individual-

ity of the cows, their feed, their period of lactation, and by the tastes of the customers. A careful butter maker soon learns to judge the condition of the cream very closely.

CHURNING.

A few hours before putting it into the churn the cream should be brought to the proper temperature by placing the cans in a tank of warm or cold water and stirring the cream occasionally until it reaches the right temperature, which should be determined accurately with the aid of a thermometer. The best temperature for churning is usually from 58° to 62° F., though special conditions may make a considerably lower or a little higher temperature desirable. The lower the temperature at which the churning is done the more labor will be required to bring the butter, the better will be the butter, and the less butter fat will be left in the buttermilk. Very rich cream, such as is usually obtained from a separator, is often churned at 50° to 52° F., while thin cream, such as is gathered from deep setting, should be churned at a temperature of 60° F. or above. When the cows are on dry feed, and especially when fed cotton-seed meal, the temperature for churning should be some degrees higher than when on fresh feed in summer. The temperature should be such that the churning will require at least fifteen minutes and not more than one hour. If the butter is to be colored, the coloring matter should be added to the cream just before it is put into the churn. No more color should be used than is necessary to give the butter a fair color, and it is much better to use too little than too much. The churn should be scalded and then rinsed with cold water just before the cream is put into it.

When the butter begins to come, which can be readily known by the sound, it should be watched very carefully so that it will not be churned too much. The churn should be stopped as soon as the butter granules are as large as grains of wheat, and a little salt, about an ounce to each gallon in the churn, should be thrown in to make the butter separate more quickly. Give the churn a few more turns, and draw off the buttermilk through a strainer which will catch any stray granules of butter. Wash the butter twice, using about a pint of cold water for each pound of the butter, revolving the churn a few times when the water is poured in, and allowing the water to remain in the churn only a few minutes each time.

Only fine dairy salt should be used. Many customers will be dissatisfied if each lot of butter does not contain exactly the same proportion of salt, and the only way by which that can be secured is to take the butter from the churn, press out most of the water, and then add the necessary amount of salt, which is usually one ounce for each pound of butter.

WORKING THE BUTTER.

The working should be only sufficient to mix the salt evenly with the butter, which should then stand from four to six hours in a temperature of from 60° to 65° F., after which it should be worked again. If the butter appears streaked at the second working, it is probably because the salt was not evenly distributed, and this second working should be only enough to make it even in color, and to remove the moisture which the salt will have gathered into drops.

Immediately after the second working the butter should be put in packages for market. For a retail trade one-pound packages done up in parchment paper are quite popular, and where one has a city trade each package may be inclosed in a cardboard or wood-veneer box. Such boxes cost very little, about 1 cent each, and in a good market will enable the user to add more than that to the price of the butter.

The successful dairyman will study his market and be ready to furnish his products in whatever form they are preferred by his customers. Some customers prefer butter made from sweet cream, others wish it with little or no salt or color, while still others may wish to have a little sugar added at the last working. There is no one item of food about which people are more particular and notional than about butter, and tastes differ widely. It is the business of the dairyman to make the kind of butter and to put it in the kind of package which will meet with the most ready sale at the highest prices.

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The following is a list of the Farmers' Bulletins available for distribution, showing the number, title, and size in pages of each. Copies will be sent to any address on application to Senators, Representatives, and Delegates in Congress, or to the Secretary of Agriculture, Washington, D. C. The missing numbers have been discontinued, being superseded by later bulletins.

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